

## SCIENTIFIC REPORT

## LASIK surgery in children

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**Aims:** To report success in the treatment of high myopia in children with LASIK. To report the visual results, complications and postoperative management of children with high myopia.

**Methods:** Six children (seven eyes) with high myopia were included in this series. Preoperative and postoperative refraction, visual acuity, and pachymetry were compared.

**Results:** Six children with high myopia ranging from  $-5.00$ DS to  $-16$ DS were treated. There were three males and three females. Five children had improved refraction and visual acuity post-LASIK. Age ranged from 2 to 12 years. Five of the children had unilateral amblyopia preoperatively. One had bilateral high myopia.

**Conclusion:** High myopia in children may be treated safely and effectively with LASIK.

Although it is estimated that over 2.5 million refractive surgical procedures are performed annually, it is an uncommon procedure in paediatric patients. A few studies have suggested that LASIK is indicated in the treatment of high myopia in children.<sup>1 2</sup>

## SUBJECT AND METHODS

Six children (seven eyes) with high myopia underwent LASIK.

Selection of patients was on the basis of failed conventional amblyopia treatment with contact lenses, spectacles, and occlusion therapy. Older children were non-compliant with spectacle or contact lens correction.

Informed consent for the procedure was obtained from the parents. The patients received a full eye examination preoperatively, including visual acuity, dilated funduscopy, refraction, corneal topography, and pachymetry. Visual acuity was measured with Cardiff acuity cards, Kays pictures, or Snellen chart, according to age. Pachymetry in uncooperative patients was performed using the mechanical ultrasound. Pupillometry was not performed. None of the children had binocular vision preoperatively as measured with Lang and Titmus stereotests.

All children underwent a general anaesthetic. The eye was cleaned with 5% betadine solution. The surgical site was draped. LASIK was performed in the more myopic eye in five cases and both eyes in one case.

Pilocarpine 1% was instilled preoperatively to prevent distracting hippus. It was necessary to perform a lateral canthotomy in two cases.

The Technolas 217 excimer laser (Bausch and Lomb) was used. The video tracker was engaged during the surgery. The Hansatome with the modified smaller suction ring and zero compression ring was used to make the incision.

A flap measuring between 8.5 mm and 9.5 mm was created and hinged superiorly.

The optic zone measured from 5.5–6.0 mm.

Postoperatively, a clear plastic shield was applied. Postoperative topical medication included, chloromycetin eye drops four times daily for 5 days and fluoromethalone 0.1% four times daily for 2 weeks. The shield was left in situ for 2 weeks.

## RESULTS

There were no intraoperative or postoperative complications. Five children had improved refraction and visual acuity at 2 year follow up (table 1) One child showed no improvement in visual acuity because of non-compliance with postoperative patching. Preoperative spherical equivalent had a mean of  $-10.2$  (SD 3.7) dioptres. Postoperatively the mean spherical equivalent improved to  $-3.0$  (SD 2.8 dioptres), mean improvement in spherical equivalent was 7.2 (SD 1.6) dioptres. None of these children has shown myopic regression to date.

## DISCUSSION

The performance of refractive surgery in children is in its infancy and is still controversial. Indications for performing refractive surgery in the paediatric setting have been categorised.<sup>3</sup> We categorised indications as obligatory/critical, functional and elective. Obligatory indications included children under the age of 7 with anisometropic amblyopia who were intolerant of spectacles or contact lenses. Functional indications include performance of LASIK in older children to allow them to participate more fully in sport and other activities of daily living. Elective indications are reserved for older teenagers with adequate corrected vision and include all indications for which refractive surgery is currently performed in adults, including cosmesis. Current practice dictates that only children who fall into the obligatory category are treated with refractive surgery.

There are only a handful of studies reporting the performance of LASIK or photorefractive keratectomy (PRK) in children. Rashad reported improvement in visual acuity with no complications at one year post LASIK in children with myopic anisometropia and amblyopia.<sup>1</sup> These patients had LASIK in the more myopic eye. Agarwal reported good refractive outcome in children with unilateral high myopia but three eyes developed grade two corneal haze.<sup>2</sup> Nassaralla treated nine children aged 8–15 years with high myopia or myopic astigmatism with anisometropia. Surgery was performed under sedation. There was good visual outcome but one child developed epithelial ingrowth.<sup>4</sup> There is some resistance to performing refractive surgery in the paediatric population. Potential pitfalls include myopic regression, glare if the optic zone is too small, decrease in contrast sensitivity, and persisting amblyopia.<sup>5</sup>

Three studies have reported the results of PRK in children, with the largest series reporting results in 27 children (40 eyes) with anisometropia and high myopia.<sup>6</sup> All had surgery under general anaesthetic. The mean preoperative spherical equivalent decreased from  $-10.68$  to  $-1.37$  dioptres at 1 year and the mean best corrected visual acuity improved to 20/70–20/40. Forty per cent of patients developed corneal haze.<sup>7</sup> A

**Table 1** Pre-LASIK and post-LASIK

Pt	Age (years)	Refraction (pre)	BC VA (pre)	Pachy (µm)	Laser	Refraction (post)	VA (post)	Pachy (post)
1	12	-5.0/-3.0@25°	6/24	535	-5.25/-2.5@37° OZ 5.5	Plano	6/15	430
2	9	Plano -2.0/-1.0@80° -8.5/-1.5@30°	6/6 6/9	622		Plano		
3	2	-14D	6/18 CF	620 530	-8.5/-1.5@30° OZ 6 -10D (RE) OZ 5.5 -9D (LE)	-1.0/ +1.25@70° -5.0D	6/18 6/15	451 416
4	2	-12D Plano -8.0/-0.75@75°	CF 6/6 CUSUM HM	530 557	-7.0D (LE) OZ 6	-4.0D Plano -3.0D	6/15 6/6 6/60	430 410
5	6	Plano -6.0D	6/6 6/24	560	OZ 6 -6.0D (LE)	Plano -1.0D	6/24	420
6	3	-14.5/-2.0@180° -7.0/-2.0@180°	6/60 6/18	560	-8.0D (RE)	-6.75/ -2.5@19°	6/18	430

CUSUM = central unsteady unmaintained fixation, OZ = optical zone (mm), CF = counting fingers, D = dioptres, HM = hand movements.

few small studies have shown a higher tendency towards corneal haze post-PRK in children.<sup>8-9</sup> PRK has also been shown to produce more corneal haze and regression in high myopes.<sup>10</sup> A 5 year follow up post-PRK in adults indicated that myopic regression was three times more likely in high myopes than in low myopes.<sup>11</sup>

In our series, all patients had surgery for myopic anisometropia or high myopia. Six out of seven patients had improved visual acuity and none experienced complications. All of the patients underwent general anaesthesia. We used pilocarpine to reduce the problem of pupil dilation caused by general anaesthesia. The age profile of our series is younger than others, with our youngest patient aged 2 years. We used a smaller corneal ring size and in some children it was necessary to perform a lateral canthotomy. We applied a shield continuously for 24 hours postoperatively and ensured a residual corneal thickness greater than 410 µm.

We disagree with the performance of refractive surgery in children under local anaesthesia and certainly this would not be possible in the younger age groups. One author reported safe and effective LASIK and PRK under topical anaesthesia in cooperative children aged 9–14.<sup>12</sup> We have concerns about the use of PRK, particularly in higher degrees of myopia, which includes the group of children most likely to require treatment. Disadvantages include immediate pain management, longer visual rehabilitation, corneal haze, and myopic regression. This has been our experience in adults with high myopia treated with PRK. There are no randomised controlled trials comparing the efficacy of PRK and LASIK in children.

The child's visual development is in a continuous state of flux. Therefore, it is important to highlight that the goal of refractive surgery in children is to achieve symmetry rather than emmetropia. Anisometropic amblyopia prevents the development of binocular single vision.<sup>13</sup> Myopic anisometropic amblyopia is most refractory to treatment, because of non-compliance with spectacle or contact lens wear.<sup>14</sup> Conversely, it is also the most amenable to surgery. It is important to note that occlusion therapy may be necessary after surgery.

There are alternatives to LASIK such as phakic intraocular lens implantation and in the past; epikeratophakia. Phakic IOLs are associated with complications such as glaucoma, cataract formation, and endophthalmitis.<sup>15</sup> Epikeratophakia yields long term integrity and stable visual acuity.<sup>16</sup> However, it carries the risks inherent in donor tissue. LASIK is advantageous over other types of refractive surgery because

it allows more rapid restoration of vision, minimum post-operative discomfort, and a lower incidence of corneal haze and preserves Bowman's membrane.<sup>17</sup>

Clearly, children need a comprehensive preoperative examination. In our series, LASIK is only indicated where conventional treatment regimens have failed. The main objective is to remove or minimise the amblyogenic stimulus in the form of optical defocus. Although spectacles may be required postoperatively, the achievement of refractive symmetry reduces the risk of amblyopia. We recognise that aniseikonia is a potential complication; however, none of these children have so complained to date. Axial length measurements would require another general anaesthetic in younger children. The parents must be fully informed that LASIK is a new procedure with potential complications, that their child's eye is growing, and that we are still not aware of the long term effects of LASIK.

In summary, refractive surgery, particularly LASIK, at present offers hope in myopic anisometropia, particularly where traditional therapy has failed. There are specific considerations, including anaesthesia, preoperative examination, surgical technique and postoperative care. With careful follow up and long term experience, LASIK may also be extended to other indications including post-cataract surgery and refractive accommodative esotropia. Conventional management strategies afford excellent outcome in terms of visual acuity, binocular single vision, and ocular alignment. Glasses are the current treatment of choice in accommodative esodeviations.<sup>18</sup> However, the majority of children never get out of glasses and long term spectacle wear may inhibit emmetropisation as the lens removes the retinal blur, which is most likely the stimulus for the myopic shift towards emmetropisation.<sup>19</sup>

Larger studies and long term follow up are necessary to fully elucidate the safety and efficacy profile of LASIK in children. In the meantime, we advocate the use of LASIK in children with anisometropia and high myopia to treat amblyopia refractory to conventional management regimes.

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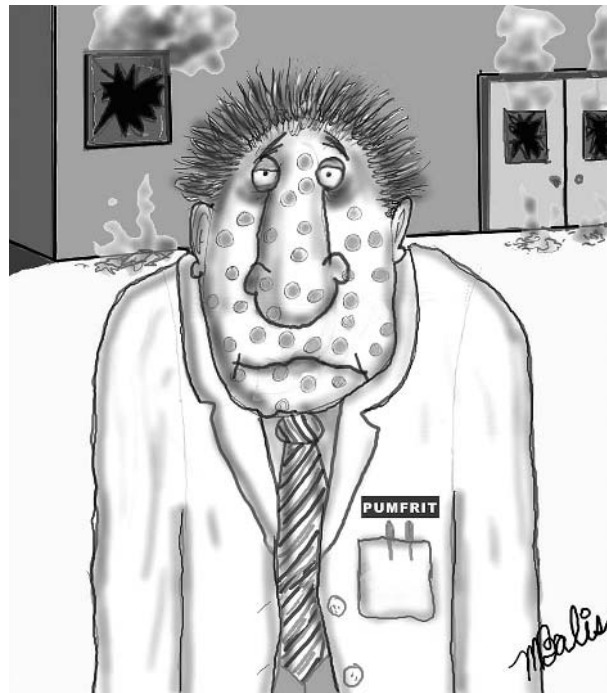
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# The lighter side



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